Quarterly Climate Impacts and Outlook

Gulf of Maine Region

September 2014

Gulf of Maine Significant Events - *for June–August 2014*

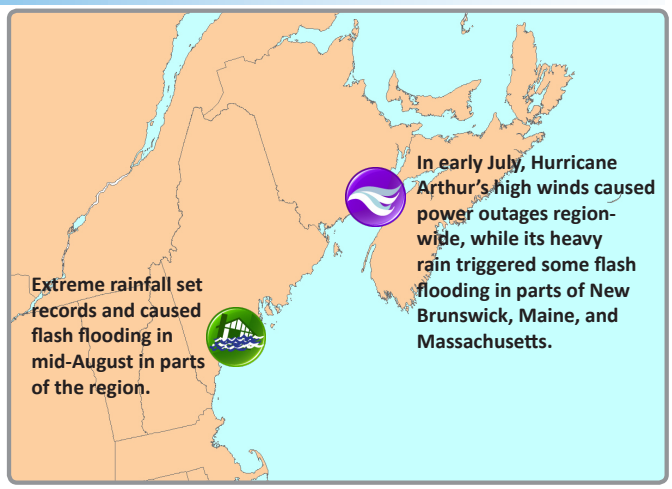
Rounds of heavy rain occurred throughout the region in June. New Brunswick saw 50–80 mm (2–3 in.) of rain from June 5–7, with the highest total of 95 mm (3.75 in.) in Grand Manan. From June 25–26, parts of Maine and New Hampshire saw up to 118 mm (4.66 in.) of rain, which caused flash flooding.

Several consecutive days of heat and high humidity occurred in late June and early July. Heat warnings were in place for New Brunswick for up to a week. On July 2, Miramichi, NB, set a daily record high of 34.5°C (94°F), and Caribou, ME, tied its all-time warmest low temperature of 21.7°C (71°F). In addition, Caraquet, NB, had its warmest July on record (since 1889).

Hurricane Arthur moved through the region on July 4–6. New Brunswick, eastern Maine, and coastal Massachusetts saw heavy rain, with many sites exceeding 100 mm (3.94 in.). The greatest total was reported at Upsalquitch Lake, NB, at 192 mm (7.56 in.). Wind gusts exceeded 90 km/h (56 mph) at nearly 30 locations in the Maritimes, with a max gust of 138 km/h (86 mph) in Greenwood, NS. See the Regional Impacts section on the next page for details.

Straight line winds of up to 161 km/h (100 mph) damaged hundreds of trees in Maine, New Hampshire, and Massachusetts in early and mid-July. An EF-1 tornado caused damage in Somerset County, ME, on July 15, and another EF-1 tornado occurred in York County, ME, on July 28. Also on the 28th, an EF-2 tornado touched down in Suffolk County, MA, making it the first tornado to strike the county since records began in 1950.

Due to dry conditions in much of Nova Scotia, the area burned by forest fires this summer was more than twice the recent 5-year average (but less than the 10-year average). New Brunswick had wet conditions, and the area burned by forest fires was about half the recent 5-year and 10-year averages. Abnormally dry conditions persisted through summer in parts of Massachusetts.

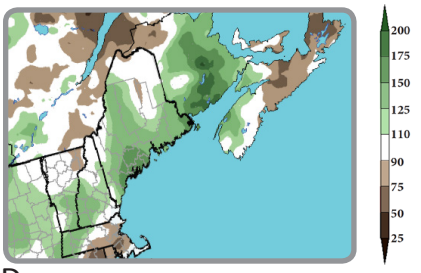


Extreme rainfall caused flash flooding in parts of the region on August 13–14. Portland, ME, had 163 mm (6.43 in.) of rain on the 13th, making it the greatest daily precipitation for any calendar day that was non-tropical based. The site saw 65 mm (2.57 in.) of rain from 9 p.m. to 10 p.m., setting a new hourly record. Another 42 mm (1.64 in.) of rain fell from 10 p.m. to 11 p.m. The consecutive two-hour rain total of 107 mm (4.21 in.) also set a record. New Brunswick saw up to 111 mm (4.37 in.) of rain. In southern Maine, the runoff overwhelmed sewer systems, prompting the closure of some clam flats and beaches due to potentially contaminated water.

Regional Climate Overview - *for June 1–August 31, 2014*

Precipitation

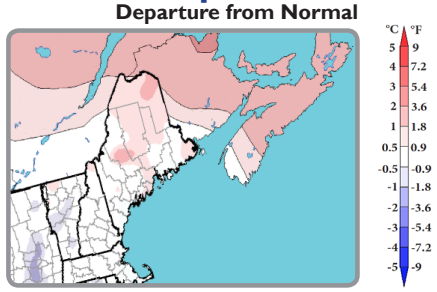
Percent of Normal



During summer, the region saw 50–200% of normal rainfall. Massachusetts, northwestern New Brunswick, and northern Nova Scotia were drier than normal. Most of Maine, New Hampshire, and New Brunswick were wetter than normal. Precipitation was highly variable in June, ranging from 25% to 225% of normal. The driest areas were in Massachusetts and southern New Hampshire, while the wettest areas were in southern New Brunswick and western Nova Scotia. In July, the U.S. and New Brunswick saw 150–300% of normal rainfall due in part to Hurricane Arthur. The three states ranked this July among their top 15 wettest. Southern Nova Scotia saw near-normal rainfall, but northern areas saw 25–75% of normal. In August, much of the region saw 25-110% of normal precipitation; however, portions of southern coastal Maine saw up to 275% of normal.

Temperature

Departure from Normal

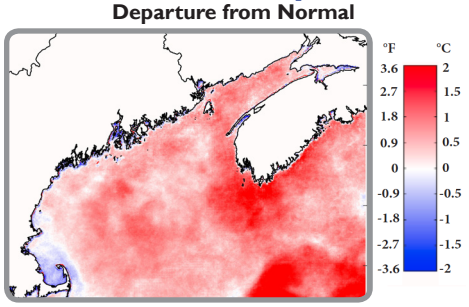


Summer temperatures were near normal in Massachusetts and New Hampshire, but were up to 2.0°C (3.6°F) above normal in parts of Maine. The Maritimes were 1.0°C (1.8°F) to 3°C (5.4°F) warmer than normal. June temperatures ranged from near normal to 2°C (3.6°F) above normal. July was a little warmer, with temperatures up to 3°C (5.4°F) above normal. Temperatures varied greatly in August. Much of Massachusetts and New Hampshire were 0.5°C (0.9°F) to 2°C (3.6°F) cooler than normal. Maine's temperatures ranged from 2°C (3.6°F) below normal to 2.0°C (3.6°F) above normal. In the Maritimes, temperatures generally ranged from 1.0°C (1.8°F) below normal to 1.0°C (1.8°F) above normal.

Temperature and precipitation normals based on 1981–2010. Canada and ocean precip data: Canadian Precipitation Analysis. U.S. precip data: interpolated station data.

Sea Surface Temperatures

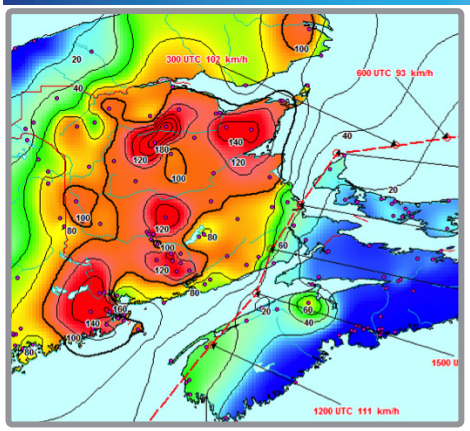
Departure from Normal



Sea surface temperatures during summer were generally warmer than normal. Warm anomalies of +0.5°C (+0.9°F) to +1.0°C (+1.8°F) dominated the Scotian Shelf, the Bay of Fundy, and the Gulf of Maine. The warmest anomalies of around +1.5°C (+2.7°F) were located along the inshore portion of the southern Scotian Shelf. The warm anomalies were weakest over the deeper waters of Jordan Basin and the shallow waters of Georges Bank. The exceptions to this warm pattern were in Massachusetts Bay and directly east of Cape Cod, with cold anomalies of around -0.5°C (-0.9°F). The regions of cold anomalies and weak warm anomalies were primarily a result of cooler conditions in July and August.

Sea surface temperature anomalies based on 1985–2014. Mean SST anomalies from NOAA AVHRR data. Credit: University of Maine School of Marine Sciences and NERACOOS

Regional Impacts - *for June–August 2014*



Above: Total precipitation (mm) on July 4-6 from Arthur. Below: Uprooted elm tree and downed power lines in Fredericton, NB, on July 6. Credit: Rick Fleetwood

Hurricane Arthur

Arthur made its Canadian landfall in western Nova Scotia as a near-hurricane strength post-tropical cyclone on July 5. The maximum sustained winds of near 110 km/h (68 mph) downed trees and power lines across the Maritimes. Nearly 200,000 customers lost power in New Brunswick, making it the largest blackout in the province's history. Around 245,000 customers lost power in Nova Scotia, making it the most severe storm for the province since Hurricane Juan in 2003. Most areas had power restored within several days, but a few spots did not have power for a week or more. Arthur's winds made apple orchards in the Maritimes more susceptible to fire blight, a bacterial infection. Over 90% of apple orchards in Nova Scotia were affected, with many young trees badly damaged. In addition, the storm's heavy rain caused some flash flooding and infrastructure damage. Provincial government offices in Fredericton were closed for a day. (Sources: CBC News, July 14 and September 3)

Ocean Acidification

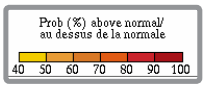
This spring, Maine became the first U.S. East Coast state to pass an ocean acidification bill into law. The law formed the Maine Ocean Acidification Committee, which held its first meeting on August 1. The group will study and address the effects of ocean acidification on Maine's environment and economy. Ocean acidification occurs when carbon dioxide in the air dissolves into seawater, creating carbonic acid and lowering the water's pH (making it more acidic). Higher acidity can inhibit shell growth in organisms such as lobsters, clams, oysters, etc. In addition, higher acidity makes it difficult for corals to build skeletons. The committee will report its findings in December. (Sources: Portland Press Herald, June 27 and Gulf of Maine Research Institute)

Invasive Species

Invasive green crab populations in the Gulf of Maine soared in 2012 and 2013 with record warm water temperatures. Comparatively fewer green crabs were found in Maine in 2014, likely due to cooler water temperatures along the coast during the 2013-2014 winter. However, crab populations in Massachusetts rebounded by July. Green crabs feed on soft-shell clams, one of Maine's major commercial fisheries, and eelgrass, which acts as a nursery for many marine species. With climate change expected to further warm Gulf waters, scientists anticipate further increases in the green crab population. (Sources: Bangor Daily News, August 14 and Massachusetts Division of Marine Fisheries)

Regional Outlook - *for Fall 2014*

Temperature



Environment Canada and NOAA's Climate Prediction Center are both calling for an increased likelihood of above-normal temperatures for the Gulf of Maine region for September through November. The forecast for above-normal temperatures is supported by climate models. In addition, sea surface temperatures around the Maritimes and in the Gulf of Maine are warmer than normal, which will help maintain warm conditions on land.

A: Above-normal
40: Probability of above-normal temperatures

Probability of above-normal
33% 40% 50% 60%

Environment Canada map (above) produced on August 31. Climate Prediction Center map (right) produced on August 21.

Precipitation

Environment Canada and NOAA's Climate Prediction Center are both predicting equal chances of above-, near-, or below-normal precipitation for September–November.

El Niño

While some warming of the tropical Pacific Ocean waters did occur in August, El Niño conditions remained neutral as of early September. However, model forecasts continue to predict El Niño development. According to NOAA, "El Niño is favored to emerge during September–October, and to peak at weak strength during the late fall and early winter." There is a 60–65% chance of El Niño development during fall and winter. (Sources: Climate Prediction Center El Niño forecast and El Niño blog)

Atlantic Hurricane Season

NOAA's updated Atlantic hurricane season outlook, released on August 7, calls for a 70% chance of a below-normal season. The initial outlook from May called for a 50% chance of a below-normal season. The updated outlook, which includes hurricanes Arthur and Bertha, predicts 7–12 named storms, 3–6 hurricanes, and 0–2 major hurricanes. In comparison, the May outlook predicted 8–13 named storms, 3–6 hurricanes, and 1–2 major hurricanes. The outlook changes are due to the development of atmospheric and oceanic conditions that inhibit storm formation, the expectation that unfavorable conditions will persist through the season, and the likely development of El Niño. (Source: Climate Prediction Center Hurricane Outlook)

Gulf of Maine Region Partners

Environment Canada
www.ec.gc.ca
Northeast Regional Climate Center
www.nrcc.cornell.edu
National Oceanic and Atmospheric Administration
www.noaa.gov
National Operational Hydrologic Remote Sensing Center
www.nohrsc.noaa.gov
NOAA Sea Grant Network
www.seagrant.noaa.gov
Northeast River Forecast Center
www.erh.noaa.gov/nerfc
Climate Prediction Center
www.cpc.noaa.gov
Regional Climate Services
www.ncdc.noaa.gov/rcsd
Gulf of Maine Research Institute
www.gmri.org
State Climatologists
www.stateclimate.org
National Integrated Drought Information System
www.drought.gov
Cooperative Institute for the North Atlantic Region
www.cinar.org
Gulf of Maine Council on the Marine Environment, Climate Network
www.gulfofmaine.org/climatenetwork
Northeastern Regional Association of Coastal and Ocean Systems
www.neracoos.org
University of Maine, School of Marine Sciences
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This is a new publication designed to help others understand climate trends and their impacts. We welcome your feedback.